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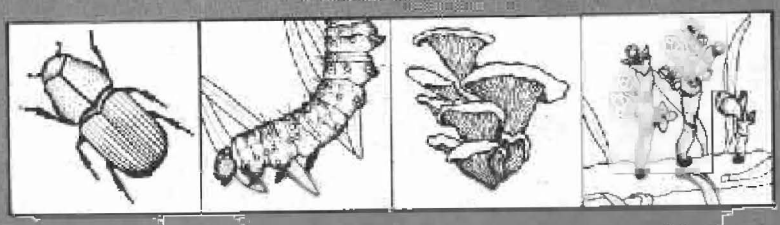

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FUNGICIDE TESTS TO CONTROL BOTRYTIS BLIGHT OF CONTAINERIZED WESTERN LARCH AT THE CHAMPION TIMBERLANDS NURSERY, PLAINS, MONTANA

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by

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ABSTRACT

Five fungicides were evaluated to control Botrytis blight of containerized western larch seedlings at the Champion Timberlands Nursery, Plains, MT. Fungicides were applied at biweekly intervals before and after seedling inoculation with Botrytis. Vinclozolin (Ornalin®) caused severe phytotoxicity to seedlings, resulting in enhanced mortality and premature needle loss. Captan and chlorothalonil (Bravo 500®) stunted seedlings. Botrytis caused very little damage in this test. Control strategies should incorporate fungicide application with cultural operations that reduce seedling susceptibility and chances for infection.

INTRODUCTION

Botrytis blight is one of the most damaging diseases affecting production of containerized conifer seedlings in greenhouses in the western United States. The disease is caused by the fungus Botrytis cinerea Pers.: Fr., which is a pathogen of more than 200 plant species (Jarvis 1980). The fungus readily colonizes necrotic plant tissues which serve as food bases from which infection of live tissues occurs. Prolonged periods of cool, wet conditions favor infection (Blakeman 1980). In conifer greenhouses, infection hazard is greatest when seedling crowns form a dense canopy (Smith et al. 1973). Within this canopy, moisture may be retained on foliage long enough to allow fungal spores to germinate and infect live tissues (Blakeman 1980).

Control of Botrytis blight is often difficult because the fungus may attack many different types of plant tissues at any stage of their development (Maude 1980). Cultural operations, such as sanitation, providing adequate air circulation among plants, and limiting irrigation are usually necessary to control this disease (Cooley 1981). However, cultural operations alone may not provide adequate control, and growers

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often have to rely on application of fungicides to keep losses at acceptable levels.

Reliance on fungicides to control Botrytis blight has often lead to problems. Some strains of the fungus have developed resistance to several commonly used fungicides, rendering their continued use ineffective (Cooley 1981; Gillman and James 1980; James and Gilligan 1983). Resistance is especially common when one chemical is used repeatedly.

In an effort to develop fungicide application schedules that will provide better disease control, growers have used several different chemicals, often applied in rotation. Several recently introduced fungicides have excellent potential against Botrytis diseases (Powell 1982). Continued problems with Botrytis blight at the Champion Timberlands Nursery (Plains, MT) and failure of fungicides used in the past to adequately control the disease prompted us to evaluate the efficacy of several fungicides, including some of these new chemicals, against the pathogen.

MATERIALS AND METHODS

Procedures for this test were similar to those described previously for the Coeur d'Alene Nursery in Idaho (James et al. 1982). The test was conducted on containerized western larch (Larix occidentalis Nutt.). Five fungicides were evaluated for their ability to control the disease (table 1). Application of an equal amount of tap water served as a check.

Western larch seed for the test came from two different locations in western Montana. Lot 1--used in the check, captan, and chlorothalonil treatments--was collected during the fall of 1978 at 1,400 m elevation (Section 34, T25N, R25W, Principal Meridian). Lot 2--used in the check, iprodione, vinclozolin, and dicloran treatments--was collected at 1,580 m elevation (Section 21, T11N, R20W, Principal Meridian). Collected seed was soaked in tap water for 8 hours, rinsed, and wrapped in paper towels. Seed was then stratified for 21 days at 1° C.

Seeds were sown in styrofoam containers with 160 cavities of 65.6 cm^3 capacity each. Growing medium consisted of a 50:50 mix of sphagnum peat moss and vermiculite. Each cavity was sown with 3-5 seeds during April 1982. After sowing, seeds were covered with 5-7 mm of granite grit. Cavities were thinned to one seedling each during the last week of May.

Seedlings were fertilized at periodic intervals throughout the growth cycle beginning May 21. Standard nitrogen, potassium, and phosphorus mixture fertilizers which also contained necessary micronutrients were applied.

Fungicides were applied seven times at biweekly intervals from July 7 to October 3 through the overhead irrigation system. Each treatment consisted of 160 seedlings replicated 5 times (4,800 total seedlings in the test). To insure uniform exposure to Botrytis, seedlings were inoculated with a spore suspension of the fungus on July 26, after two

Table 1.--Fungicides tested to control *Botrytis cinerea* on containerized western larch at the Champion Timberlands Nursery, Plains, MT.

Fungicide	Trade name	Chemical name	Application rate/ 100 gal. water	Manufacturer
iprodione	Chipco 26019®	3-(3,5-dichlorophenyl)-N-(1-methylethyl)-2,4-dioxo-1-imidazolidinecarboximide	1 lb.	Rhone-Poulenc
vinclozolin	Ornalin®	3-(3,5-dichlorophenyl)-5-ethenyl-5-methyl-2,4-oxazolidinedione	1 lb.	Mallinckrodt
chloro-thalonil	Bravo 500®	Tetrachlorosiophtalonitrile	2-3/4 pt.	Diamond-Shamrock
captan	Captan	N-(Trichloromethylthio)-4-cyclohexene-1, 2-dicarboximide	2 lb.	Stauffer
dicloran	Botran®	2,6-Dichloro-4-nitroaniline	1-1/3 lb.	Tuco

fungicide applications had occurred. Spore concentration was approximately 1.5 x 10^6 conidia/ml in sterile distilled water. Each container tray of 160 seedlings was inoculated with 10 ml of the spore suspension using a fine mist atomizer. The B. cinerea isolate used for these inoculations was obtained from western larch seedlings in storage at the Plains nursery.

The test was completed in late October when seedlings were ready for shipment to the field. Each seedling was then examined for necrosis caused by B. cinerea by peeling away bark at its base to see if the cambium was alive. Seedling heights were also tallied. Data were analyzed with an analysis of variance and Duncan's Multiple Range Comparison Test.

RESULTS AND DISCUSSION

Mortality of test seedlings was low for all treatments except vinclozolin (table 2). Losses in the water (check) treatments were also low, indicating that the Botrytis isolate used was not virulent enough to cause much damage in our test. The high mortality in the vinclozolin treatment was likely due to phytotoxicity rather than Botrytis infection. Seedlings treated with vinclozolin became reddish-purple in color and prematurely lost much of their foliage (fig. 1), whereas those treated with water or the other test fungicides were generally green and healthy looking (fig. 2). Several defoliated trees in the vinclozolin treatment had green buds and could possibly recover; however, most were dead with necrotic cambial tissues. Since recommended label rates were used in the vinclozolin treatments, we do not know why there was such apparent phytotoxicity. Similar rates were used on western larch seedlings without phytotoxic responses in beds at the Coeur d'Alene Nursery in Idaho (James et al. 1983). However, these seedlings were in their second growing season and may not have been as sensitive to the fungicide as young, container-grown seedlings. Also, uptake of the chemical may be much more rapid in containerized seedlings because the growing medium is peat moss instead of a loam soil.

Table 2.--Effects of selected fungicides on containerized western larch seedling mortality at the Champion Timberlands Nursery, Plains, MT.

Treatment	No. dead seedlings 1/	Percent seedling mortality
water (check)	10 A	1.2
iprodione	2 A	0.1
vinclozolin	176 B	22.0
chlorothalonil	7 A	0.9
captan	6 A	0.8
dicloran	13 A	1.6

1/ Values followed by the same capital letter are not significantly different (P = 0.05) using Duncan's Multiple Range Comparison Test.

Figure 1.--Containerized western larch seedlings treated with vinclozolin (Ornalin®) at the Champion Timberlands Nursery, Plains, MT. Many seedlings were defoliated; foliage of treated seedlings often became reddish-brown in color.

Figure 2.--Containerized western larch seedlings treated with water (check) at the Champion Timberlands Nursery, Plains, MT. Most seedlings in this and other fungicide treatments (except vinclozolin) remained green and healthy looking.

The Botrytis isolate used in this test was isolated from dormant seedlings in storage rather than actively growing ones. Strains of the fungus with different pathogenic capacities have been identified (Jarvis 1980). It is possible that the isolate used was more adapted to saprophytism and not virulent enough to overcome host resistance and cause much infection. There were also no noticeable Botrytis problems on nontest seedlings in the same and adjacent greenhouses during the year of the test. Growers kept seedlings well ventilated and temperatures were fairly high throughout much of the growing season. These factors may have contributed to the low damage to seedlings caused by Botrytis in our test.

Several fungicides significantly reduced height growth of the test seedlings (table 3). Seedlings treated with chlorothalonil and captan were particularly stunted. Similar responses of larch seedlings to these chemicals were found in previous tests (James et al. 1982; James et al. 1983). Mechanisms by which fungicides reduced seedling height are unknown.

Table 3.--Effects of selected fungicides on height of containerized western larch seedlings at the Champion Timberlands Nursery, Plains, MT.

Treatment	Avg. seedling height (mm) 1/	95% confidence interval
water (check)	152.6 A	149.9 - 155.2
iprodione	150.0 A	147.2 - 152.8
vinclozolin	141.3 B	138.3 - 144.3
chlorothalonil	118.9 C	117.2 - 120.6
captan	116.8 C	115.2 - 118.4
dicloran	137.5 B	134.9 - 140.1

1/ Means followed by the same capital letter are not significantly different (P = 0.05) using Duncan's Multiple Range Comparison Test.

Results of this test indicate that some fungicides can cause toxic reactions and reduce height of containerized western larch seedlings, even though they may effectively control Botrytis blight. Therefore, growers should be selective in applying fungicides and should do so only when the disease is likely to cause damage. Cultural operations such as maintaining clean greenhouses, removing diseased stock, providing adequate air circulation among plants, and limiting irrigation should be part of an effective Botrytis control strategy. Fungicides should be used at the lowest possible label dosage that will provide adequate disease control. This will help reduce chances of phytotoxicity and possible tolerance of fungal strains to chemicals (Cooley 1981; James and Gilligan 1983). Also, different fungicides should be rotated so that the fungus does not become tolerant to any one chemical. An integrated program incorporating both cultural and chemical control methods will help reduce future losses to Botrytis blight.

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This publication reports research involving pesticides. It does not contain recommendations for their use, nor does it imply that the uses discussed have been registered. All uses of pesticides must be registered by appropriate State and/or Federal agencies before they can be recommended. CAUTION: Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife--if they are not handled or applied properly. Use all pesticides selectively and carefully. Follow recommended practices for the disposal of surplus pesticides and pesticide containers.

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